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SHORT COMMUNICATION

First Record of the Mycoheterotrophic Orchid *Gastrodia uraiensis* (Orchidaceae) from Yakushima Island, Japan

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Flowering individuals of an unknown species of *Gastrodia* were discovered on Yakushima Island, Japan. While those plants were somewhat similar to *Gastrodia fontinalis*, they had shorter inflorescences, a shorter perianth tube and different number of ridges on the labellum, a combination of characteristics remarkably similar to those of *G. uraiensis*, which was considered to be endemic to Taiwan. Given that there were only minor differences between the original description of *G. uraiensis* and the plants on Yakushima Island, it was concluded that they were the same species. They represent the first known occurrence of *G. uraiensis* outside of Taiwan. .

Key words: *Gastrodia*, new locality, mycoheterotroph, Orchidaceae

The genus *Gastrodia* (Orchidaceae) comprises approximately 50 species of mycoheterotrophic orchids distributed throughout temperate and tropical regions of Asia, Oceania, and Madagascar (Chung & Hsu 2006). The genus is characterized by having either fleshy tubers or a coralloid underground stem, absence of leaves, united sepals and petals, and two mealy pollinia lacking caudicles (Pridgeon *et al*. 2005, Chen *et al*. 2009, Cribb *et al*. 2010, Hsu & Kuo 2010, 2011).

Gastrodia exhibits extraordinary morphological diversity, with some species of section *Gastrodia* (*sensu* Schlechter 1911), such as *G. elata* Blume reaching 60–100 cm in height during the flowering season, while many species of section *Codonanthus* (Schlechter 1911, Tuyama 1967), as represented by *G. verrucosa* Blume (the G. verrucosa group), have inflorescences that are only 3–15 cm long at flowering, although during fruiting, they extend to 30–40 cm long as a result of the elongating pedicels (Chung & Hsu 2006). Consequently, plants belonging to section *Codonanthus*, as is the case with most mycoheterotroph species, are rarely found during the flowering season. As a result, they have not been studied in detail (Tuyama 1982, Suetsugu *et al*. 2012). Furthermore, with the absence of detailed descriptions for some species it has been difficult to conduct adequate taxonomic studies of section *Codonanthus*. Despite these limitations, our recent botanical surveys of the mycoheterotrophic plants in the Ryukyu Islands of Japan has resulted in discoveries of additional members of section *Codonanthus*, including several new species, such as *G. takeshimensis* Suetsugu (Suetsugu 2013) and *G. flexistyloides* (Suetsugu 2014), as well as new distribution records for *G. shimizuana* Tuyama (Suetsugu *et al*. 2012), *G. clausa* T. C. Hsu, S. W. Chung & C. M. Kuo (Suetsugu *et al*. 2013) and *G. fontinalis* (Suetsugu *et al*. 2014).

Considering the richness of the mycoheterotrophs discovered in the Ryukyu Islands, it is likely that comparative studies and re-examination of the mycoheterotrophic species in neighboring regions can also provide useful data regarding the mycoheterotrophic flora of Japan. Of particular interest are the lowland evergreen forests of Yakushima Island, which are known to be hotspots for endemic taxa, including the mycoheterotrophic *Oxygyne yamashitae* (Burmanniaceae) (Yahara & Tsukaya 2008). It was therefore hoped that a detailed botanical survey of Yakushima Island would provide more precise data regarding species diversity and the distribution of plants in section *Codonanthus* in Japan.

During the most recent botanical survey in this area, I collected plants of section *Codonanthus* in lowland evergreen forests on Yakushima Island that I did not recognize. Based on the morphology, I determined them to be *G. uraiensis* T. C. Hsu, S. W. Chung & C. M. Kuo (Fig. l). Here I report the first occurrence of that species in Japan and provide a description of the plants from Yakushima Island.

Gastrodia uraiensis T. C. Hsu & C. M. Kuo in Taiwania **55** : 244 (2010) —Fig. l.

Specimen examined. JAPAN. Kagoshima Pref., Yakushima Island, along the Tabu River. 18 April 2015, K. Suetsugu *s.n.* (TNS) Japanese name. Tabu-gawa-yatsushiro-ran, **nom. nov.**

Herbs, terrestrial, mycoheterotrophic. Rhizome tuberous, fusiform or cylindrical, 3–9 cm long, 5–9 mm in diameter, yellowish brown, covered with numerous scales. Leaves absent. Inflorescence erect, pale brown, 2–6 cm long, 2–3 mm in diameter. Bracts ovate, ca. 4 mm long. Pedicel and ovary 6—10 mm long. Flowers 1–5, bell-shaped, slightly nodding or angled slightly upward, resupinate, ca. 13 mm long, ca. 8 mm in diameter. Sepals and petals united, forming a 5-lobed perianth tube. Sepals subsimilar, fleshy, 11–13 mm long, connate ca. 2/3 the length of the petals, lateral sepals connate ca. 3/5 their length with each other, outer surface dark brown, slightly verrucose, margins entire; free portion of dorsal sepal straight, ovate-triangular, retuse, ca. 5 mm long, 5 mm wide; free portions of lateral sepals spreading, apex obtuse. Free portions of petals ovate or elliptic, ca. 3 mm long, 1.5–2 mm wide. Labellum adnate to column foot, 6–7 mm long, 2–2.5 mm wide; hypochile with 2 orange globose calli; epichile orange at base, greenish white in middle, dark red at apex, ovate-triangular, base contracted, with 4 elevated ridges on upper portion, with 2 ridges extending to ligulate apex. Column straight, terete, 6–7 mm long, 2 mm wide, white tinged and reddish brown at base; column foot well developed; lateral wings narrow, red, edges parallel to column, apex acute; rostellum ca. 0.7mm long; stigma located at base. Anther hemispheric, ca. 1 mm in diameter, pollinia 2.

Distribution. along the Tabu and Onna rivers at an elevation of ca. 100–180 m on the lower slopes of Mt. Aiko in eastern Yakushima Island. The two populations known are in humid evergreen broadleaved forests dominated by *Castanopsis sieboldii*, *Distylium racemosum* and *Machilus thunbergii* and a sparse herbaceous understory. Each population consisted of ca. 10 flowering individuals.

Although the lowland humid evergreen forests flanking the rivers in Yakushima Island have previously been identified as hotspots for endemic plant species, only a small proportion of the area is currently under protection (Yahara *et al*. 1987), even though 61% (20,989 ha) of Yakushima Island is designated a National Park, and 21% (10,747 ha) a World Natural Heritage site (Yahara & Tsukaya 2008). Consequently, one of the two populations of *G. uraiensis* remains unprotected in an evergreen forest along the Tabu River adjacent to a *Cryptomeria* plantation that has recently been cut (the nearest distance between the deforested area and *Gastrodia* population is less than 15 m). Considering that *G. uraiensis* is completely dependent on their host fungi and specific pollinators (Suetsugu unpublished data), it is important to conserve the entire ecosystem of their surrounding habitat. Further regulations restricting forest logging and construction are therefore re-

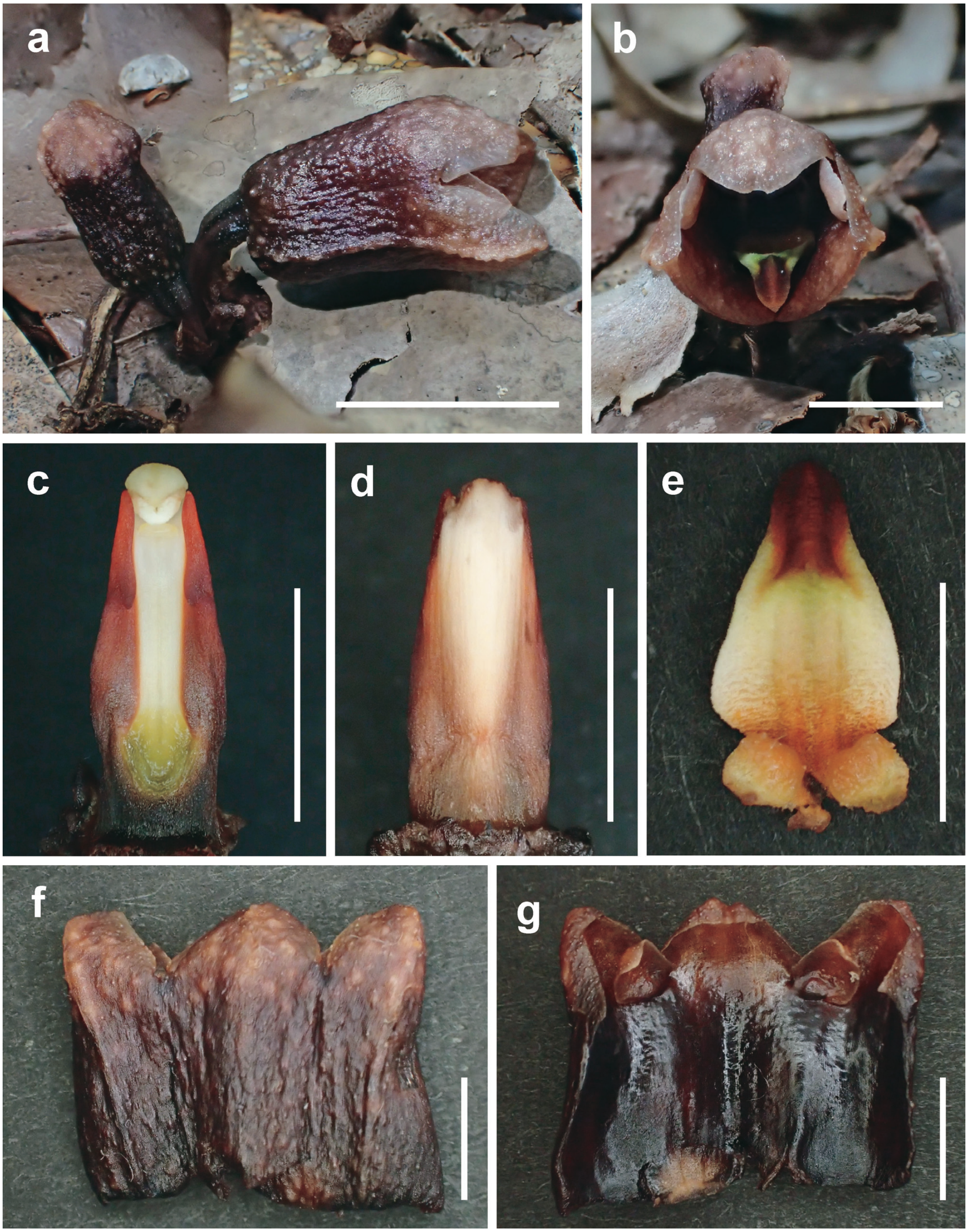

FIG. 1. **a, b:** Flowering plants of *Gastrodia uraiensis*. **c, d:** Column (c, lower view. d, upper view. lower view). **e:** Lip. **f, g:** Expended and flattened perianth tube (f, outer surface. g, inner surface). a: bar = 1 cm. c-g: bar = 5 mm.

quired to conserve the flora and fauna and the numerous endemic species that are restricted to low altitude habitats on Yakushima Island.

Notes. *Gastrodia* on Yakushima Island resembles *G. fontinalis*, but differ in that they have a shorter inflorescence (2–6 cm vs. 7–24 cm), a shorter perianth tube (11–13 mm vs. 15–21 mm), different coloration of their perianth tube (dark brown vs. pale brown) and different labellum morphology (4 ridges vs. 6–8 ridges). The characteristics of the plants on Yakushima Island more closely match the description of *G. uraiensis* (Hsu & Chung 2010) and it was therefore concluded that they are the same species, which represents the northernmost occurrence of the species and the first record of its in Japan. Despite their similarities, however, there are a few minor differences between the plants on Yakushima Island and the original description of *G. uraiensis*, most notably in the coloration of the labellum (epichile orange at base, greenish white in the middle, dark red at apex vs. red-brownish). Given that there are no other differences in the labellum and column morphology, which are important characteristics used in distinguishing the species of *Gastrodia*, the relatively minor differences are attributed to intraspecific variation.

The continued discovery of new species and range extensions for *Gastrodia* in southern Japan indicates that a large number of undescribed species may remain hidden in this area. Considering that these discoveries were made from only a limited number of surveys within a small selection of sites (Suetsugu *et al*. 2012, 2013, 2014, Suetsugu 2012, 2013, 2014), it is likely that more extensive surveys during the flowering season could reveal much more precise data regarding the diversity and distribution of the species of *Gastrodia*, information that could prove critical for the conservation of section *Codonanthus* in southern Japan.

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